PROTECTA
Electronics Co. Ltd

EuroProt

complex numerical device

DVTA-EN-EP

factory configuration

automatic transfer device

EUROPROT

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1 Application, main characteristics

1.1 Application field

The devices of the EuroProt complex protection family are modular devices. The modules are selected, assembled and configured according to the tasks to be performed. This manual describes one of the several possibilities: the DVTA-EN-EP factory configuration. The general description concerning the EuroProt devices can be found in the document „EuroProt complex protection, hardware and software description and user's manual", (further "EuroProt manual").

The **DVTA-EN-EP** factory configuration produced by PROTECTA Electronics Co. Ltd. is assembled to perform automatic transfer between an operating and a reserve power transformer or incoming feeder, supplying a busbar. The device can be implemented in substations, where there is a high requirement to minimize the breakdown time do to loss of power supply. The DVTA-EN-EP device performs the transfer between the normal and the standby power supply with the highest possible speed.

The further SCADA options extend the device to the complex bay unit for the medium voltage network.

1.2 Main characteristics

The ***EuroProt*** protection family of PROTECTA Co. Ltd. is based on microcontrollers and on fully numerical signal processing technology.

The device is programmed for continuous self-supervision, which can be extended to the external CB close and open circuits as well.

The event log can store up to 50 events and event sequences for up to 300 digital events with 1 ms time resolution.

The device includes a real-time clock with battery RAM support. This clock can be synchronised from an external PC or from the SCADA system. Additionally a Word Time Synchroniser device (GPS-OP) produced by PROTECTA Co. Ltd. is available as well.

The disturbance recorder integrated in the CPU module can record up to 11 records. The total recording time is about 4 s. The integrated disturbance recorder function of the devices stores all sampled voltage signals and the digital status signals, enabling off-line analysis of the processes.

The device realises several measuring functions based on the available analogue signals.

The design and the man-machine interface of the device is described in the „EuroProt complex protection, hardware and software description and user's manual", (further "*EuroProt manual*"). The device can be controlled more conveniently using an external PC and the „**Protect for Windows"** software. The operation of this program is explained in the "*EuroProt manual*" too.

The external communication can be performed either via serial RS 232 interface isolated for 2 kV, or via two fibre optic connectors integrated in the rear side of the CPU. The methods of external communication are described in the "*EuroProt manual*" too.

2 The automatic transfer function

A **DVTA-EN-EP** automatic transfer function satisfies all special requirements of the customers. This technical document describes one of the possibilities, and the R/D department of Protecta is ready to make changes to adapt the device to the requirements of any applications.

In this application the large number of high power motors, connected to the busbar induce the special requirements. If the power infeed supplying the busbar fails to deliver the power supply voltage, then these rotating motors, - due to the application of capacitors for phase correction - keep the induced state for a longer time, and the speed of rotation decreases slowly according to the load and the inertia of the rotors. During this period the vector position of the motor voltage shifts continuously. If the reserve infeed is switched on at a random moment, the voltage can be in opposite position as compared to the reserve supply voltage, and the consequence is a high current surge, and a possible damage of the rotating motor shafts.

To avoid the switchover at a wrong moment, the **DVTA-EN-EP** configuration controls the automatic switchover to the reserve infeed.

The present configuration is prepared to support different station configurations.

2.1 Configuration with two busbar sections and infeeds

One of them contains two infeeds, and the busbar can be divided into two parts by a circuit breaker. The coupled operation of the two infeeds is usually not permitted.

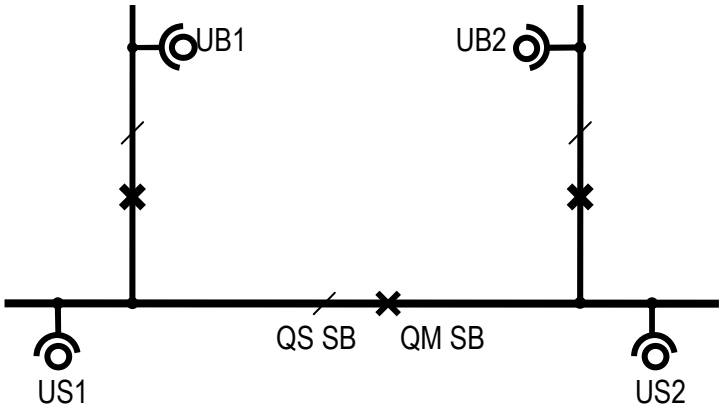


Fig. 1 Configuration with two transformers

The automatic transfer means disconnecting the infeed with a failure very rapidly, and then the appropriate circuit breaker dividing the bus sections or the circuit breaker connecting the reserve infeed is closed at a moment, when the stress of the rotating motors is minimal. Of course transfer is possible only if the voltage side to be switched on is considered to be healthy (the voltage is above a predefined level). The device supports all possible operating states of the busbar.

The triggering signal for the switchover is the starting signal of the infeed protection devices, and the switchover can be initiated manually as well.

2.2 Configuration with three busbar sections and three infeeds

The other configuration consists of three infeeds and three busbar sections. It is supposed that the normal operation of the substation means energised state of the infeeds, and the circuit breakers coupling the busbar sections are switched off.

In the case of the configuration with three sections a second switchover resulting operation with one infeed only can be enabled or disabled by setting a digital parameter.

The hardware limitations of a single device allow support of two infeeds only; the three infeed configuration is controlled by two co-operating similar devices. The information exchange is performed by relay contacts and optically isolated digital inputs between the two devices. To preserve symmetry of the substation, the voltage measurements of the two transformers located on both sides are connected to the analogue voltage input module No. 1 of both devices, and the voltage of the infeed in the middle is measured by both devices on the analogue voltage input module No. 2.

In this configuration the software of both devices is identical with the software of the device controlling two infeeds; the only requirement is to connect the communication channels between the devices.

2.3 General features

The program of the switchover function continuously measures the phase voltages of the four voltage transformer groups indicated in Fig.1 (These are the voltages of both infeeds and both busbar sections). Based on the phase voltages the line-to-line voltages are calculated for the further signal processing. The voltage of a voltage transformer group is considered to be healthy, if two from three line-to-line voltages are above the level defined by a parameter setting (single phase fault on the above voltage level don't cause switchover trigger); the voltage can be evaluated if at least one line-to-line voltage is above a minimal level, defined by another parameter value.

The program calculates angle position and frequency of the "RS" line-to-line voltages received from the four voltage transformer groups.

The evaluation of the voltages is based on the voltage level and the angle difference between the following voltages (See Fig.1).:

- B1 and S1, which means one infeed voltage and the voltage of the adjacent busbar section,
- S1 and S2, which means the voltage of both busbar sections,
- B2 and S2, which means the other infeed voltage and the voltage of the adjacent busbar section.

3 Operation of the automatic transfer function

3.1 States of the substation

Based on the circuit breaker and disconnector positions indicated by status signals, three states of the substation can be recognised, which are suitable to initiate switchover (see Fig. 1):

b1s1s2-b2 state of operation: B1 and SB ON, B2 OFF and all disconnectors ON;
b1s1-s2b2 state of operation: B1 and B2 ON, SB OFF and all disconnectors ON;
b2s2s1- state of operation: B2 and SB ON, B1 OFF and all disconnectors ON.

These states are frozen till the end of the switchover procedure, so the changing status signals can not cause faulty recognition of the states.

The scheme picture of the graphic LCD on the front side indicates the actual positions: if the circuit breakers and the disconnectors are ON, then the LED symbols show with symbolic lights this status. In OFF position the LED symbols are dark; in case of contradictory status signals the LED-s are blinking.

3.2 Modes of operation

There are three different modes of operation:

1 „Instantaneous" transfer: this mode is possible, if an event triggers the action, and the angle difference between the two voltage vectors is under the predefined limits (and the angle is expected to remain below 60 degrees when the circuit breaker poles close after the circuit breaker operating time).
2 „Fast" transfer: this mode of operation is triggered by the angle difference between two voltage vectors. The close command is generated in advance before 360 degrees relative rotation of the voltage vectors, taking into consideration the operating time of the circuit breaker. (Based on the experiences during the first rotation the shape of the voltage remains approximately sinusoidal, later it is distorted because of the different speed of the motors.)
3 "Slow" transfer: in this mode of operation the switchover is delayed until the voltage of the motors decays below a small level, and the closing of the circuit breaker will not generate higher currents then a normal motor start.

The following paragraphs describe the different modes of operation in details:

3.2.1 Instantaneous transfer method

The instantaneous transfer mode of operation needs a triggering event, received on a dedicated digital input. This event can be a trip command to the circuit breaker on the high voltage side of the transformer or incoming feeder.

The controlled receipt of the signal on the digital input needs 4 ms. The processing of the logic equations needs 2 ms. The reaction time for the auxiliary relay of the circuit breaker can be estimated to 8-10 ms. If the operating time of the circuit breaker is 60 ms, then the total processing time is 82 ms. This time is needed for the decision to transfer to the reserve power supply.

The operating time of the output relay is additional 8-10 ms, and the circuit breaker operating time is further 60 ms. The requirement is that the angle difference at the moment of closing the contacts should be below 60 degrees. (60 degrees means normal starting state for the motors on the busbar.)

The calculation with normal loss of speed of the motors results 17 degrees phase difference to generate the close command. (If there is considerable phase difference between the normal and the reserve supply voltages, this angle will be even less.)

An instantaneous transfer can be initiated only, if both voltages are above the specified limit as well.

The instantaneous transfer can be enabled or disabled by parameter setting.

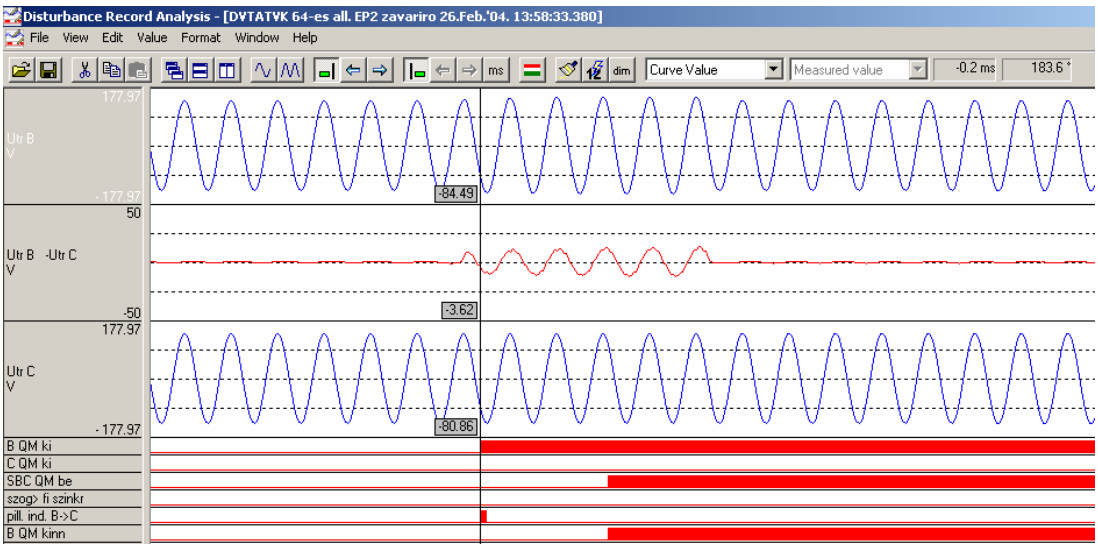


Fig. 2 The instantaneous transfer mode of operation

3.2.2 Fast transfer method

The method of processing the fast transfer procedure is based on constant deceleration, which means squared increase of the angle difference. In the calculation method there are three selected phase angle values: 58 degrees, 130 degrees and 360 degrees. Because of the deceleration the elapsing time between the first two angle differences is half of that between the second two values. (See Fig.3)

The algorithm measures the elapsing time between 58 and 130 degrees. The circuit breaker operating time is subtracted from the double value of this measured time, to get the moment of generation of the close command to the circuit breaker. So at the moment of closing the contact the angle difference will be 360 degrees, which means phase coincidence (synchronous position) again. This connection between phase angle differences and time differences is valid only during the first rotation, so after the first reach of 58 degrees the possibility of another fast transfer start is prohibited.

If the subtraction results negative value, then the remaining time is not sufficient for the correct closing of the circuit breaker. In this case the automatic transfer device turns to “slow” transfer mode of operation. The automatic transfer device turns also to “slow” transfer mode of operation, if the voltage of the busbar fell below 20% of nominal voltage at 130 degrees, because in this case the result of the phase angle measurement is unreliable.

The fast transfer starts when both voltages are above the defined higher level and the angle difference reaches 58 degrees. For closing the circuit breaker of the reserve power supply, the other circuit breaker should be in OFF position.

The fast transfer method can be enabled or disabled with parameter setting.

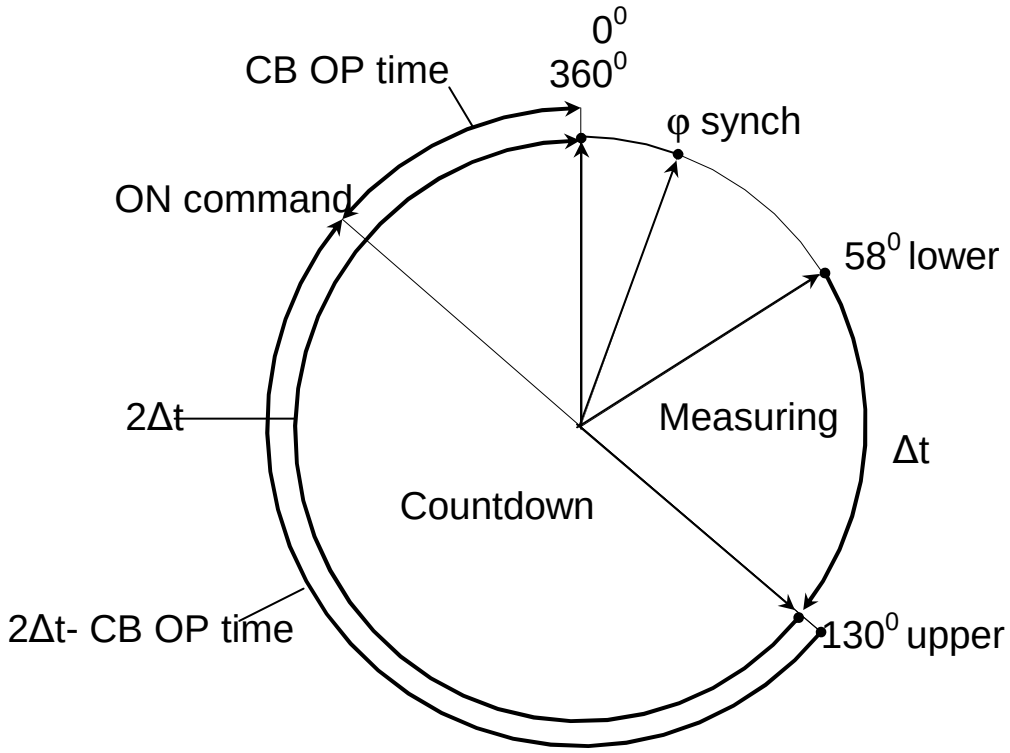


Fig. 3 Vectors during the fast transfer switching

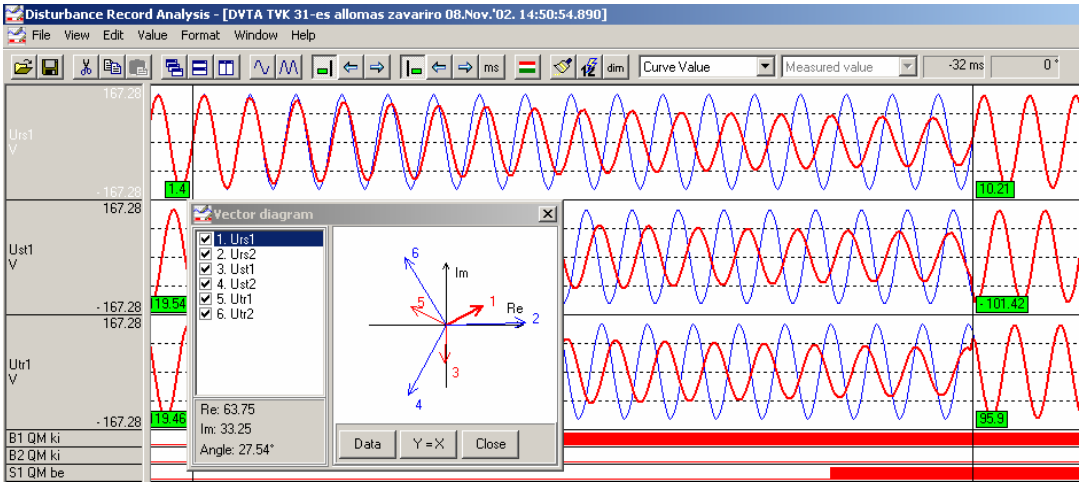


Fig. 4 Voltages and vectors during the fast transfer switching

3.2.3 Slow transfer method

If the fast transfer method can not be carried out because of quick decay of the busbar voltage or because the deceleration of the vector rotation, then the automatic transfer device turns to “slow” transfer mode of operation.

Using the slow transfer method means that the closing command is delayed until the busbar voltage decays below the defined limit. In this case the device waits the elapsing of an additional time delay (this can be set to zero as well), and then generates the close command to the circuit breaker of the reserve power supply. When the circuit breaker of the reserve power supply closes, the other circuit breaker should be in OFF position.

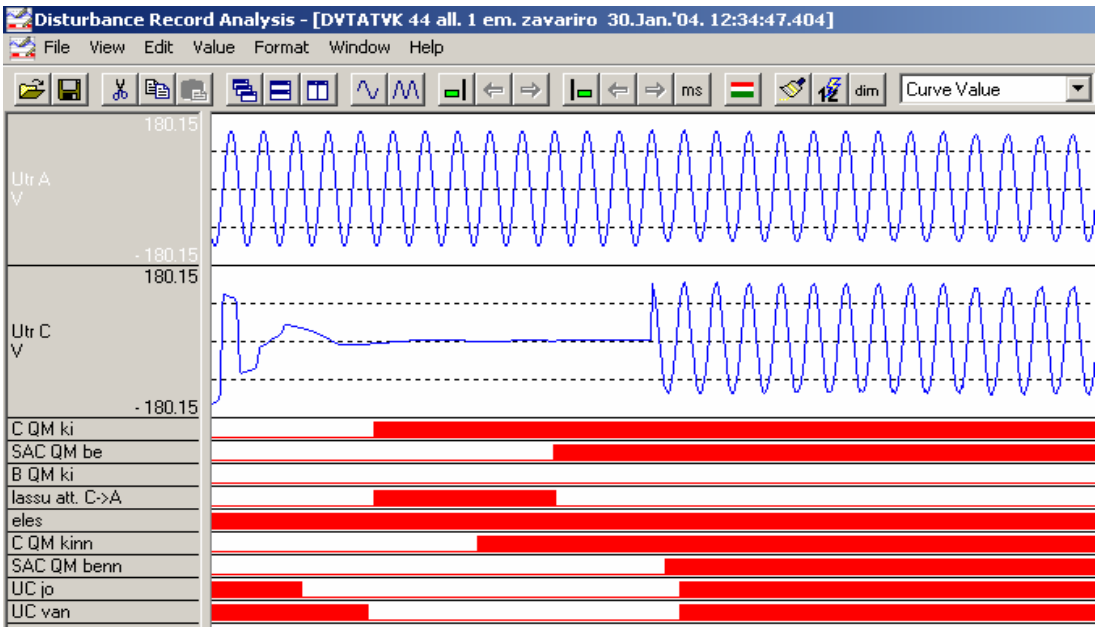


Fig. 5 Voltages during the "slow" transfer switching

3.3 Transfer with parallel operation of the transformers

The parallel operation of two transformers is permitted for a short duration only. If the transfer function detects parallel operation, one of the three circuit breakers must be switched off automatically.

The circuit breaker to be switched off can be defined by dedicated inputs, connected to a switch with three possible positions.

If a transfer is initiated manually, only the open circuit breaker is to be closed by a manual command; the appropriate circuit breaker is opened automatically.

4 Operating states of the device

The operating states of the device can be “Enabled”, “Disabled” or “Blocked”.

4.1 Active operating state

The switchover device can be activated or deactivated by “device enable” parameter setting or by digital inputs. The digital inputs can be enabled or disabled by the “remote enabled” parameter. If the device is not active, the transfer function gets deactivated, and even a started transfer procedure will be interrupted. If the device returns to active state again, no acknowledgement is needed.

4.2 Disabled operating state

Received dynamic information can disable the operation of the device (for example VT MCB failure, contradictory status of circuit breakers or disconnectors, disable signal from protections in case of short circuit on the busbar, local control of any circuit breaker etc.) . If any of the disabling signals is active, the operation of the transfer function is not possible, even a started transfer procedure will be interrupted. If the device returns to active state again, acknowledgement is needed.

4.3 Blocked operating state

After a completed transfer procedure or exceeding the timeout without transfer the device gets in blocked operating state. For possibility the following transfer the device must be acknowledged.

The device generates a message about a successful and about the failed transfer procedure as well. At triggering the transfer procedure a timer is started. If after this “Timeout” the appropriate circuit breaker does not send information about the closed state, the procedure was unsuccessful. (To achieve correct messages the parameter must be set to a longer delay then the expected slowest transfer procedure.)

5 Technical data

Power supply rated voltage	:	220V DC
Power consumption	:	20/25 V
Binary input rated voltage	:	220V DC
Analogue input rated voltage	:	100 V
Consumption voltage path	:	1 VA
Binary output contacts	:	SIEMENS V2306-B1006-A601
Rated voltage .	:	250 V
Thermal load, continuous	:	8 A
Making current	:	16 A
Breaking current		
Conductive load	:	0.25 A
L/R=40 msec	:	0.14 A
Operation temperature	:	0 - 50 °C

Type tests

Surge tests	:	2 kV, 50 Hz	(IEC 255-5-6)
		5 kV ,1.2 / 50 msec	(IEC 255-5-8)
Disturbance tests		2.5 kV ,1 MHz	(IEC 255-22-1)
Electrostatic discharge		8 kV	(IEC 255-22-2)
Radio frequency disturbance		10 V/m	(IEC 255-22-3)
Repeated fast transients		2 kV	(IEC 255-22-4)

6 User interface to the device

6.1 Parameter setting, using "Protect for Windows"

The Figures in this chapter show the Parameters window in the "Protect for Windows" operation software open for communication wit a DVTA-EN-EP device. The application of this software is described in the "EuroProt manual".

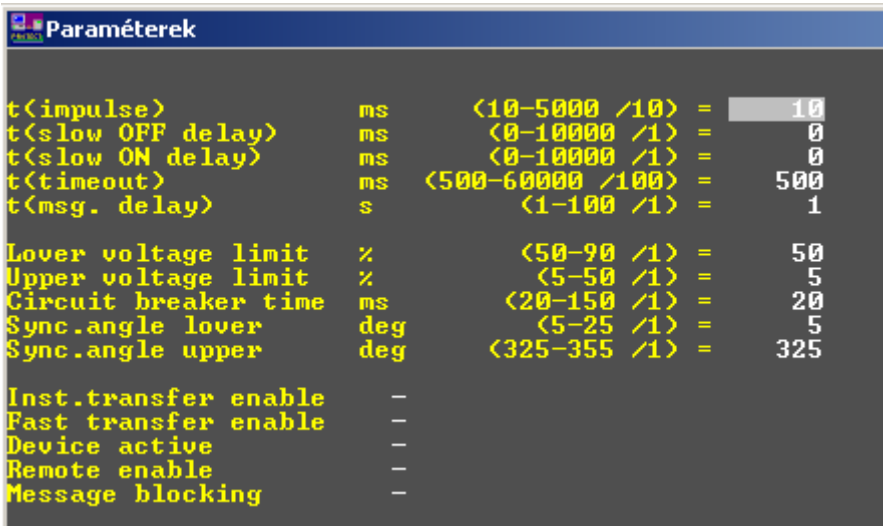


Fig.6 The "Parameters" Window of „Protect for Windows" operating software

The parameters are explained in the following table.

Parameter	Explanation
t(impulse)	Duration of the generated ON and OFF commands
t(slow OFF delay)	In case of slow transfer the delay of the OFF command
t(slow ON delay)	In case of slow transfer the delay of the ON command
t(timeout)	Timeout: After initiation of the transfer switching this time delay will be waited, then the decision will be made based on the status of the circuit breakers, if the transfer was successful or not.
t(msg.delay)	If the status of the switches of the substation does not allow transfer, after this time delay an alarm signal will be generated
Upper voltage limit	Voltage limit, above which the voltage is considered to be „healthy"
Lower voltage limit	Voltage limit below which the voltage is considered to be low enough to perform slow transfer
Circuit breaker time	Circuit breaker operating time
Sync.angle lower	Lower limit of the angle range to synchronous position
Sync.angle lower	Upper limit of the angle range to synchronous position

Inst.transfer enable	Enabling instant transfer mode
Fast transfer enable	Enabling fast transfer mode
Device active	- = transfer is not enabled, independently of “Remote enable” + = transfer is enabled“
Remote enable	- = disable + = enable
Message blocking	1 = no messages will be sent

6.2 On-line Window (Measurements and status signals)

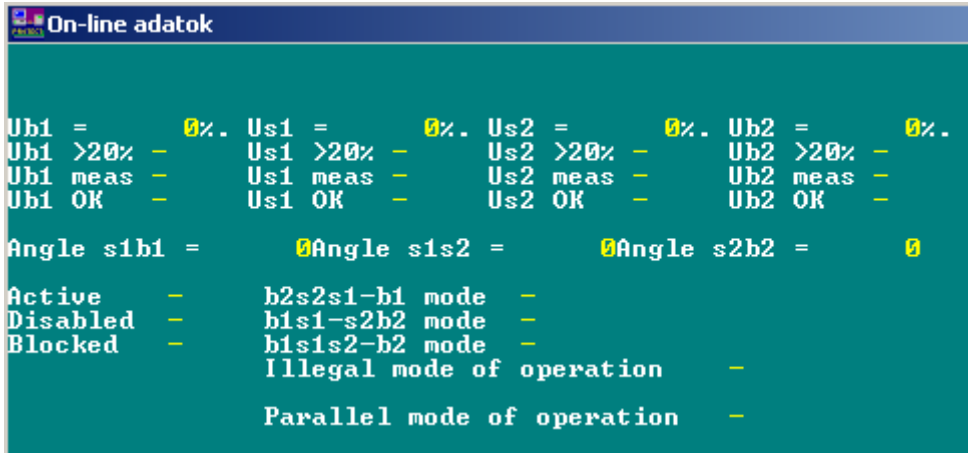


Fig.7 The “On-line” window of „Protect for Windows“ operating software

6.2.1 Voltages

Voltage	Explanation
Ub1	Voltage of the supply side 1
Us1	Voltage of the busbar section 1
Us2	Voltage of the busbar section 2
Ub2	Voltage of the supply side 2

6.2.2 Status signals for the voltages :

Status signals	Explanation
Ub1 >20%	Voltage of the supply side 1 is above 20 %
Us1 >20%	Voltage of the busbar section 1 is above 20 %
Us2 >20%	Voltage of the busbar section 2 is above 20 %
Ub2 >20%	Voltage of the supply side 2 is above 20 %
Ub1 meas	Voltage of the supply side 1 can be measured
Us1 meas	Voltage of the busbar section 1 can be measured
Us2 meas	Voltage of the busbar section 2 can be measured
Ub2 meas	Voltage of the supply side 2 can be measured
Ub1 OK	Voltage of the supply side 1 is healthy
Us1 OK	Voltage of the busbar section 1 is healthy
Us2 OK	Voltage of the busbar section 2 is healthy
Ub2 OK	Voltage of the supply side 2 is healthy

6.2.3 Measured phase angles:

Phase angle	Explanation
Angle s1b1	Phase angle between the voltage of the supply side 1 and that of the busbar section 1
Angle s1s2	Phase angle between the voltage busbar section 1 and that of the busbar section 2
Angle s2b2	Phase angle between the voltage of the supply side 2 and that of the busbar section 2

6.2.4 Status of the device and the transfer function:

Status	Explanation
Active	Active state of the transfer function
Disabled	Disabled state of the transfer function
Blocked	Blocked state of the transfer function
b2s2s1-b1 mode	B2 feeds common S1 and S2, B1 is reserve
b1s1-s2b2 mode	B1 feeds S1 and B2 feeds S2
b1s1s2-b2 mode	B1 feeds common S1 and S2, B2 is reserve
Illegal mode of operation	Illegal state of operation, transfer is not possible
Parallel mode of operation	Parallel operation of the two transformer, not allowed state

6.2.5 Status of the binary inputs

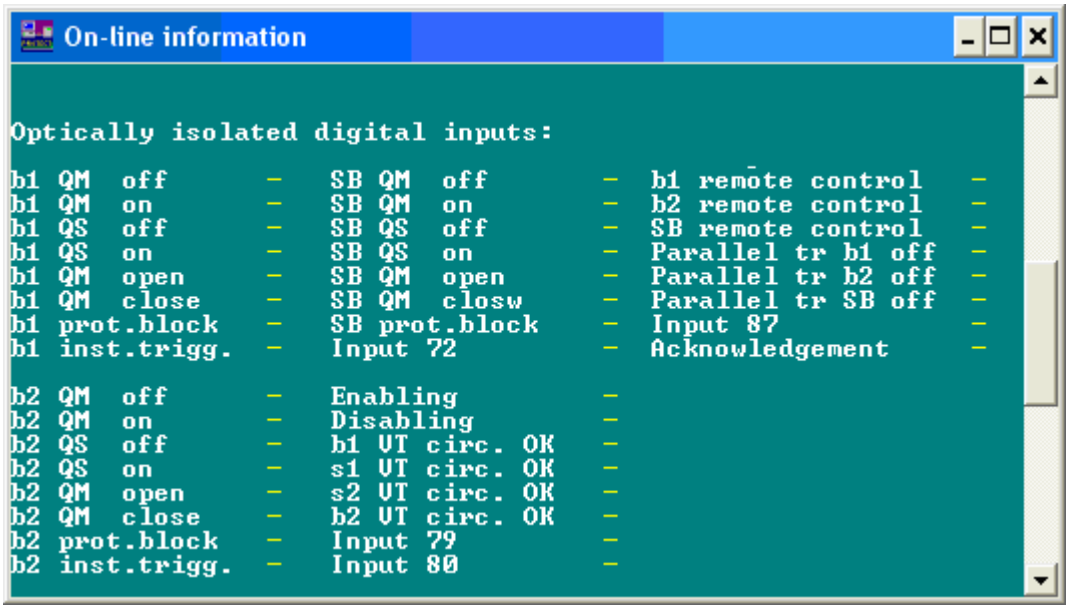


Fig.8 Status of the binary inputs in the "On-line" window of „Protect for Windows" operating software

Input	Explanation
b1 QM off SB QM off b1 QS off SB QS off	Circuit breaker of „b1" transformer is OFF Circuit breaker of the „SB" bus coupler is OFF Disconnector of „b1"transformer is OFF Disconnector of „b1"transformer is OFF
b1 QM on SB QM on b1 QS on	Circuit breaker of „b1" transformer is ON Circuit breaker of the „SB" bus coupler is ON Disconnector of „b1"transformer is ON

SB QS on	Disconnector of „b1“transformer is ON
b1 remote control b2 remote control SB remote control	Circuit breaker of „b1“ transformer is in remote operation mode Circuit breaker of „b2“transformer is in remote operation mode Circuit breaker of „SB“ bus coupler is in remote operation mode
b1 QM open b1 QM close	OFF command for the circuit breaker of „b1“ transformer ON command for the circuit breaker of „b1“ transformer
SB QM open SB QM close	OFF command for the circuit breaker of the bus coupler SB ON command for the circuit breaker of the bus coupler SB
Parallel tr b1 off Parallel tr b2 off Parallel tr SB off	OFF command to the circuit breaker of “b1” transformer OFF command to the circuit breaker of “b2” transformer OFF command to the circuit breaker of the bus coupler SB
b1 prot. block b2 prot. block SB prot. block	Transformer „b1“ diabled by a protection function Transformer „b2“ disabled by a protection function Bus coupler „SB“ disabled by a protection function
b1 inst.trig.	„b1“ instantaneous transfer triggered
Acknowledgement	Acknowledgement
b2 QM off b2 QS off	Circuit breaker of „b2“ transformer is OFF Disconnector of „b2“transformer is OFF
b2 QM on b2 QS on	Circuit breaker of „b2“ transformer is ON Disconnector of „b2“transformer is ON
b2 QM open b2 QM close	OFF command for the circuit breaker of „b2“ transformer ON command for the circuit breaker of „b2“ transformer
Enabling Disabling	Enabling Disabled
b1 VT circ.OK s1 VT circ.OK s2 VT circ.OK b2 VT circ.OK	„b1“ voltage transformer circuit is OK „s1“ voltage transformer circuit is OK „s2“ voltage transformer circuit is OK „b2“ voltage transformer circuit is OK
b2 inst.trigg.	„b2“instantaneous transfer triggered

6.2.6 Counter

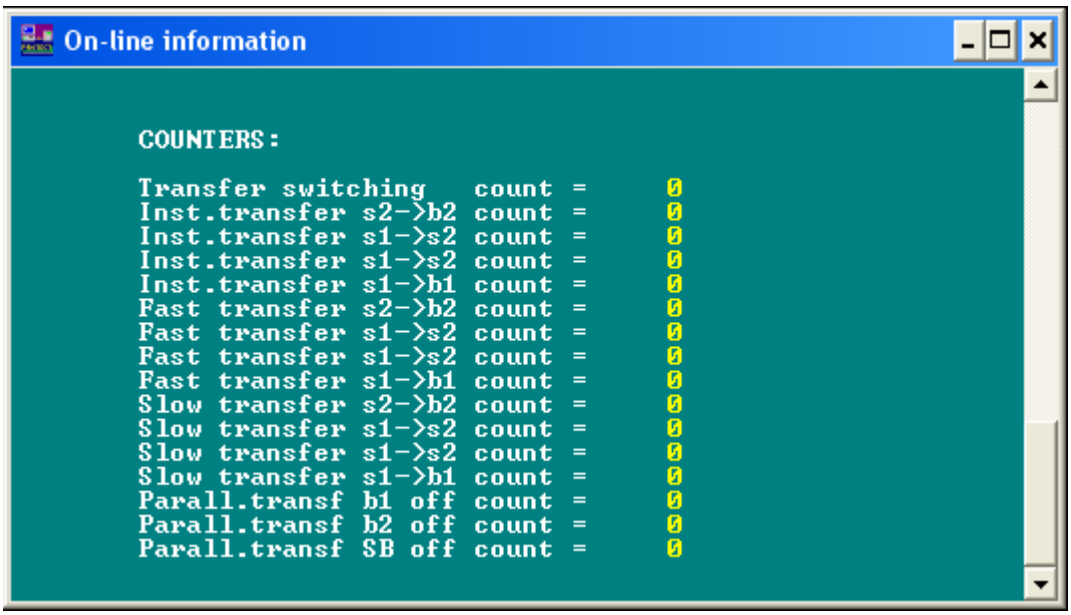


Fig.9 Counters in the "On-line" window of „Protect for Windows" operating software

Counter	Explanation
Transfer switching count	Number of triggered transfer commands
Inst transfer s2->b2 count	Number of performed s2->b2 instantaneous transfers
Inst transfer s1->s2 count	Number of performed s1->s2 instantaneous transfers
Inst transfer s2->s1 count	Number of performed s2->s1 instantaneous transfers
Inst transfer s1->b1 count	Number of performed s1->b1 instantaneous transfers
Fast transfer s2->b2 count	Number of performed s2->b2 fast transfers
Fast transfer s1->s2 count	Number of performed s1->s2 fast transfers
Fast transfer s2->s1 count	Number of performed s2->s1 fast transfers
Fast transfer s1->b1 count	Number of performed s1->b1 fast transfers
Slow transfer s2->b2 count	Number of performed s2->b2 slow transfers
Slow transfer s1->s2 count	Number of performed s1->s2 slow transfers
Slow transfer s2->s1 count	Number of performed s2->s1 slow transfers
Slow transfer s1->b1 count	Number of performed s1->b1 slow transfers
Parallel transfer b1 off count	Number of transfers without voltage interruption with b1 off
Parallel transfer b2 off count	Number of transfers without voltage interruption with b2 off
Parallel transfer SB off count	Number of transfers without voltage interruption with SB off

6.2.7 Evaluated events

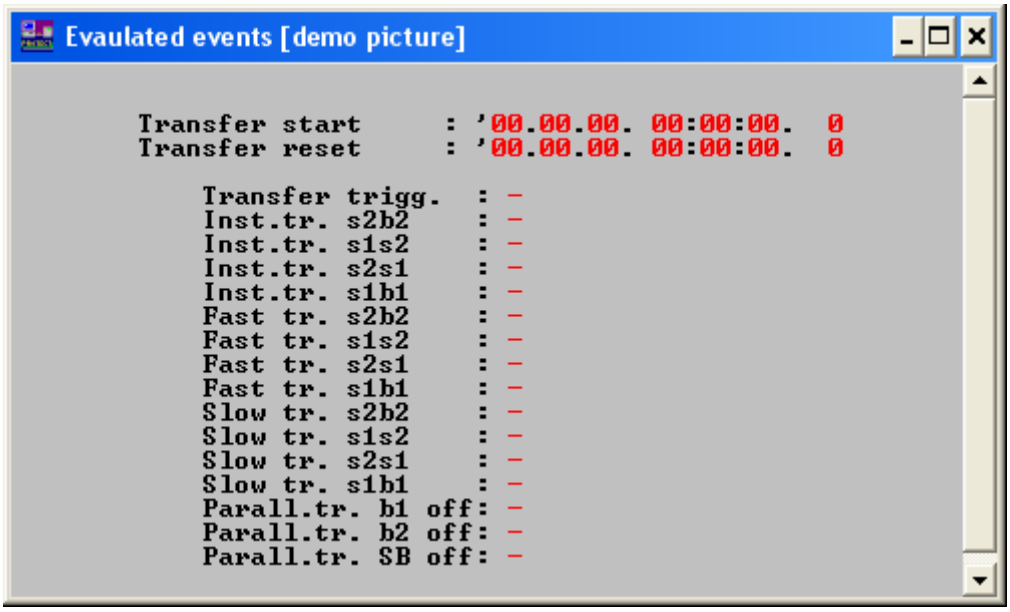
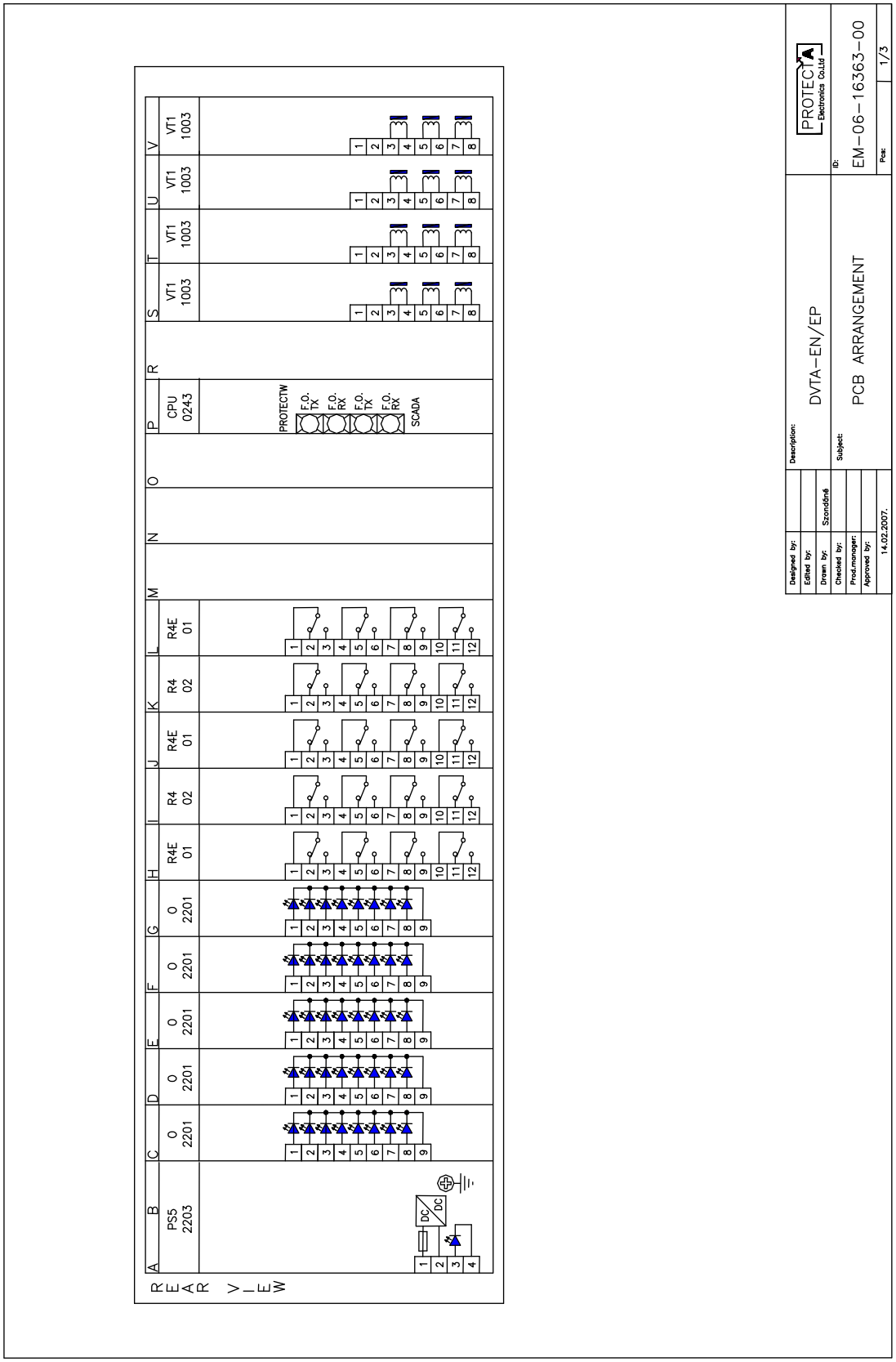


Fig.10 "Evaluated events" window of „Protect for Windows" operating software

Event	Explanation
Transfer start Transfer reset	Function triggered at … Function reset at …
Transfer trig. : Inst. tr. s2b2 : Inst. tr. s1s2 : Inst. tr. s2s1 : Inst. tr. s1b1 : Fast tr. s2b2 : Fast tr. s1s2 : Fast tr. s2s1 : Fast tr. s1b1 : Slow tr. s2b2 : Slow tr. s1s2 : Slow tr. s2s1 : Slow tr. s1b1 : Parallel tr. b1 off : Parallel tr. b2 off : Parallel tr. SB off :	Triggered transfer Instantaneous transfer s2->b2 Instantaneous transfer s1->s2 Instantaneous transfer s2->s1 Instantaneous transfer s1->b1 Fast transfer s2->b2 Fast transfer s1->s2 Fast transfer s2->s1 Fast transfer s1->b1 Slow transfer s2->b2 Slow transfer s1->s2 Slow transfer s2->s1 Slow transfer s1->b1 Transfers without voltage interruption with b1 off Transfers without voltage interruption with b2 off Transfers without voltage interruption with SB off

6.2.8 Digital events

Event	Explanation
b1 QM off	Circuit breaker of transformer „b1“ switched off
b1 QM on	Circuit breaker of transformer „b1“ switched on
b1 QS off	Disconnector of transformer „b1“ switched off
b1 QS on	Disconnector of transformer „b1“ switched on
b1 prot.block	Protection blocking from transformer „b1
b1 inst.trigg..	Triggerd instantaneous transfer from „b1“
b2 QM off	Circuit breaker of transformer „b2“ switched off
b2 QM on	Circuit breaker of transformer „b2“ switched on
b2 QS off	Disconnector of transformer „b2“ switched off
B2 QS on	Disconnector of transformer „b2“ switched on
b2 prot.block	Protection blocking from transformer „b2
b2 prot.block	Triggerd instantaneous transfer from „b1“
SB QM off	Circuit breaker of bus coupler “SB” switched off
SB QM on	Circuit breaker of bus coupler “SB” switched on
SB QS off	Disconnector of bus coupler “SB” switched off
SB QS on	Disconnector of bus coupler “SB” switched on
SB prot.block	Protection blocking from bus coupler “SB”
Enabling input	Status change of enabling
Disabling input	Status change of disabling
b1 VT circ.OK	Voltage transformer secondary circuit of „b1“ is OK
s1 VT circ.OK	Voltage transformer secondary circuit of „s1“ is OK
s2 VT circ.OK	Voltage transformer secondary circuit of „s2“ is OK
b2 VT circ.OK	Voltage transformer secondary circuit of „b2“ is OK
b1 remote	Remote controlled state of „b1”
b2 remote	Remote controlled state of „b2”
SB remote	Remote controlled state of „SB”
Par.setting	Parameter setting
Ackn.	Acknowledgement
b1 QM off	b1 QM circuit breaker OFF input
b1 QM on	b1 QM circuit breaker ON input
b2 QM off	b2 QM circuit breaker OFF input
b2 QM on	b2 QM circuit breaker ON input
SB QM off	SB QM circuit breaker OFF input
SB QM on	SB QM circuit breaker ON input
Parall.	Parallel operation
Parall. b1 off.	Transfers without voltage interruption with b1 off
Parall. b2 off	Transfers without voltage interruption with b2 off
Parall. SB off	Transfers without voltage interruption with SB off


REAR VIEW
A PS5 2203
B
C 0 2201
D 0 2201
E 0 2201
F 0 2201
G 0 2201
H R4E 01
I R4 02
J R4E 01
K R4 02
L R4E 01
M
N
O
P CPU 0243
R
S VT1 1003
T VT1 1003
U VT1 1003
V VT1 1003
PROTECTW
F.O. TX
F.O. RX
F.O. TX
F.O. RX
SCADA
DC DC
Designed by:
Edited by:
Drawn by: Szondondé
Checked by:
Prod.manager:
Approved by:
14.02.2007.
Description: DVTA-EN/EP
Subject: PCB ARRANGEMENT
PROTECTA Electronics Co.Ltd
ID: EM-06-16363-00
Pos: 1/3

"V" CT1/1003 [100V]		
No.	Name	Term.
1		
2		
3	UB1 t	6
4	UB1 n	5
5	UB1 s	4
6	UB1 n	3
7	UB1 r	2
8	UB1 n	1

"U" CT1/1003 [100V]		
No.	Name	Term.
1		
2		
3	US1 t	12
4	US1 n	11
5	US1 s	10
6	US1 n	9
7	US1 r	8
8	US1 n	7

"T" CT1/1003 [100V]		
No.	Name	Term.
1		
2		
3	US2 t	18
4	US2 n	17
5	US2 s	16
6	US2 n	15
7	US2 r	14
8	US2 n	13

"S" CT1/1003 [100V]		
No.	Name	Term.
1		
2		
3	UB2 t	24
4	UB2 n	23
5	UB2 s	22
6	UB2 n	21
7	UB2 r	20
8	UB2 n	19

"L" R4E/01		
No.	Name	Term.
1	B1 1M+	25
2		
3	B1 QM	26
4	B1J+	27
5		
6	B1 QM	28
7	B2 2M+	29
8		
9	B2 QM	30
10	B2 J-	31
11		
12	B21 QM	32

"K" R4/02		
No.	Name	Term.
1	SB	33
2		
3	SB QM	34
4	SB	35
5		
6	SB QM	36
7	+	37
8		
9	AUT	38
10		39
11		
12		40

"J" R4E/01		
No.	Name	Term.
1	J+	41
2		
3	SUCC.	42
4	J+	43
5		
6	FAIL	44
7	J+	45
8		
9	BLOCKED	46
10	J+	47
11		
12	AUT.	48

"I" R4/02		
No.	Name	Term.
1	J+	49
2		
3	DISABLED	50
4		51
5		
6		52
7		53
8		
9		54
10		55
11		
12		56

"H" R4E/01		
No.	Name	Term.
1	+	57
2		
3	B1 QM	58
4	+	59
5		
6	B2 QM	60
7	+	61
8		
9	SB QM	62
10	J+	63
11	CB MONIT	64
12		

"G" O/2201 [220V]		
No.	Name	Term.
1	B1 QM	65
2	B1 QM	66
3	B1 QS	67
4	B1 QS	68
5	B1 QM	69
6	B1 QM	70
7	B1 PROT.	71
8	B1	72
9	Opto- (1-8)	105?

"F" O/2201 [220V]		
No.	Name	Term.
1	B2 QM	73
2	B2 QM	74
3	B2 QS	75
4	B2 QS	76
5	B2 QM	77
6	B2 QM	78
7	B2 PROT.	79
8	B2	80
9	Opto- (1-8)	105?

"E" O/2201 [220V]		
No.	Name	Term.
1	SB QM	81
2	SB QM	82
3	SB QS	83
4	SB QS	84
5	SB QM	85
6	SB QM	86
7	SB PROT.	87
8		88
9	Opto- (1-8)	105?

"D" O/2201 [220V]		
No.	Name	Term.
1	ENABLE	89
2	DISABLE	90
3	UB1 OK	91
4	US1 OK	92
5	US2 OK	93
6	UB2 OK	94
7		95
8		96
9	Opto- (1-8)	105?

"C" O/2201 [220V]		
No.	Name	Term.
1	B1	97
2	B2	98
3	SB	99
4	PARALL.B1	100
5	PARALL.B2	101
6	PARALL.B3	102
7		103
8	ACKN.	104
9	Opto- (1-8)	105?

"A" "B" PS5/2203 [220V=]		
No.	Name	Term.
1	ATK+	108
2	ATK-	109
3	CLK SYNC.+	106
4	CLK SYNC.-	107

Designed by:		Description: DVTA-EN-EP	PROTECTA Elektronikai kft
Edited by:	13.02.2007		
Drawn by:	Baloghné		
Checked by:		Subject: EXTERNAL CONNECTION	ID: EM-06-16363-00
Prod.manager:			
Approved by:			Pcs: 2/3